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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
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| 09/584,739 | 06/01/2000 | Kuniko Kikuta | PF-2622/NEC/US/mh | 3028 |

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EXAMINER

QUACH, TUAN N

ART UNIT

PAPER NUMBER

2814

DATE MAILED: 01/08/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/584,739

Applicant(s)

KIKUTA, KUNIKO

Examiner

Tuan Quach

Art Unit

2814

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 18 October 2001.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-56 is/are pending in the application.
- 4a) Of the above claim(s) 38-56 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-37 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ 6) ☐ Other: _____

DETAILED ACTION

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-37 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tsuji et al., Edelstein et al. and Dubin.

Tsuji et al. teach the inclusion of various elements including P, Ni, Ag, B, As, Si, Cr, and appropriate amounts, e.g., see the abstract, column 4 lines 29-69, Table 1 and 2, column 6 lines 65-66, column 7 lines 66-68 to obtain alloys having excellent conductivity and heat resistance. The selection of appropriate amounts is also shown, e.g., column 4 lines 37-58. Tsuji et al. however do not recite all the additives claimed.

Edelstein et al. also teach copper alloys, e.g., column 6 lines 10 to column 8 line 50 wherein copper alloys including various materials, e.g., B, P, Ni, Ag, and various metal, such as Mo, W, Si, Ge, Ta, to obtain improve electromigration resistance. Application of such materials on the via hole in semiconductor device is also shown.

Dubin teaches the use of copper alloys including in via contact holes, e.g., trench 12, (including barrier 52, e.g., column 7 lines 7-21), including Cu alloy layers 56, 57, the alloys being suitable Cu alloys including alloys of Cu with any of various metal, such as Ag, Ni, etc., and wherein the alloys can also include various alloying elements such as Ni, Ag ... See column 5 line 30 to column 6 line 50.

Art Unit: 2814

It would have been obvious to one skilled in the art in practicing the Tsuji et al. invention to have included appropriate or suitable and conventional elements in the copper alloys since such inclusion is conventional as delineated in Edelstein, or Dubin wherein such alloys would have excellent conductivity and electromigration resistance. The selection of appropriate amounts and appropriate and conventional additives would have been met and further would have been within the purview of one skilled in the art given the teachings of Tsuji et al., and Edelstein et al. as delineated above. The inclusion of the copper alloys in contact to semiconductor devices including barrier thereon is well known as delineated in Edelstein or Dubin. Conversely, it would have been obvious to one skilled in the art to have employed in Edelstein or Dubin the copper alloys including appropriate amounts of the suitable additions to obtain the desired characteristics for such as electrical conductivity and heat resistance as delineated in Tsuji et al. Any additives not explicitly recited otherwise would have been obvious and would have been within the purview of one skilled in the art given the additives delineated.

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Lopatin et al., Akutsu et al., Berge et al., Nakanishi et al., Tsujimura et al., Stumborg et al., Shimizu et al., Uzoh, Lee et al. and Duran-Texte teach copper alloys of interest.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to examiner Quach whose telephone number is 703-308-1096. The examiner can normally be reached on M - F from 9 to 5. The fax phone

Art Unit: 2814

number for the organization where this application or proceeding is assigned is 703-308-7722.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.



Tuan Quach
Primary Examiner